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FOUNDRY TRADE JOURNAL

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WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL
VOL. 70. No. 1395. MAY 13, 1943
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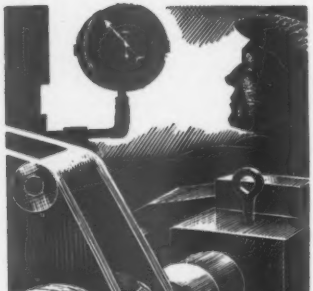

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FOUNDRY TRADE JOURNAL
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Vol. 70 Thursday, May 13, 1943 No. 1395

Austerity Castings

By the issue of British Standard Recommendations for the "Wartime Finish of Machinery and Plant," No. 1,114—1943, limitations are being imposed on the activities of Cinderella's beauty parlour, and new castings like West-End dinners enter the austerity regime. Clause 4 recommends that the fettling of castings should be reduced to a minimum, and that no efforts should be made towards the amelioration of appearance by burning, welding or filling up surface defects with cements. Moreover, after [rough] "fettling all the drilling, filing or grinding of outside surfaces should be omitted." In this connection we fail to appreciate the significance of "drilling," as this operation is not *per se* a fettling shop job. So, too, are the inside surfaces to be similarly neglected, except where it is necessary "to remove obstructions from oil and other passages." Thus there will be another headache for executives, trade union leaders and shop stewards controlling works where piecework prices have been established. Then, again, where appearance only is in question, shot blasting and pickling are to be omitted, and here it is interesting to note that no attempt should be made to improve the surface of castings by an increased expenditure on facing sand. The standard recommendations, however, do insist that sand must not be allowed to remain in positions where it would reduce cutting tool life or enter into the lubricating system of finished assemblies. A natural rider to the above is the suggested omission of barrelling where surface is the sole desideratum. Chipping is only to be used for the removal of gross excrescences. The recommendations as to the filling of castings are that as a foundation for paint it should be omitted, but as a seal for deep-seated grains of sand, which might be deleterious in connection with the purpose for which the casting is to be used, it is to be recommended. So, too, its use as a seal for oil tightness can be continued. The specification recommends the use of cored holes wherever possible, and finally "castings should not be rejected on account of blow-holes, porosity, or other flaws which do not materially affect strength or impair functioning." Another clause of interest to our readers is No. 20, which reads: "In general, display name-plates should not be fitted when the name is or can be integrally cast on the machine."

It should be realised that this is contained in a specification, and is not the law of the land. How widespread will be its use remains to be seen, but wherever it is imposed on the foundry, we suggest that the industry protects itself by labelling every component they make "war finish" in order to preserve its past good name and future prospects. This action seems to be justified, as the foundry industry, which seems to be the one which has received the major impact, has had no direct representation on the Committee responsible for its preparation. The constitution of the Mechanical Industry Committee under whose supervision this standard recommendation was prepared comprises nine representatives of Government Departments, the railway companies and seventeen scientific, technical and industrial organisations. Surely this could usefully have been extended to eighteen, and we leave it to the appropriate interests of the organised British foundry industry to give force to this very reasonable grouse. This standard is procurable at the price of 1s. post free from the British Standards Institution, 28, Victoria Street, London, S.W.1.

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METAL LOOSE PIECES

By "Checker"

Loose pieces for patterns and coreboxes are sometimes unavoidable, due to the irregular shape of the castings required, and, when this happens with production work, the loose pieces are liable to become worn; they will not fit correctly, and may be rammed out of position, while the sharp corners of any protruding parts will soon show signs of wear, and the more fragile ones have at times to be repaired or replaced owing to breakage. When the loose pieces are made in metal, it will be a considerable time before they need attention, and if, as does happen on rare occasions, a small loose piece is inadvertently left in the core, and sent round the core stove, a metal piece would not be damaged, while a wooden one would at least need reconditioning.

FIG. 1

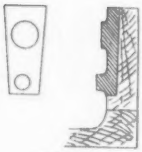

FIG. 2

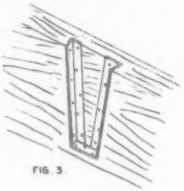

FIG. 3

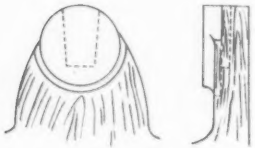

FIG. 4.

FIG. 5

Fig. 1 shows a loose piece which is required for the boss protruding from the flange face, and to hold it in the correct position a metal dovetail will be required. The master pattern should be made so that the minimum of time has to be spent making it the correct shape; a small machining allowance should be left on the flat faces, from which it can easily be removed, and only a filing allowance round the boss itself. The metal dovetail should be fitted into the loose piece and then fastened into position with screws. It is preferable to make the dovetail from a different metal to the loose piece, if the loose pieces are aluminium, then it would be advisable to make the dovetail of brass or mild steel.

One of the disadvantages of metal loose pieces for wood patterns or coreboxes is that the continual rubbing of metal against wood soon wears away the surface of the wood; this, however, will not be so pronounced where a metal dovetail is used, as shown in Fig. 1, as the metal dovetail takes most of the pressure and saves the wood. To counteract the metal rubbing against the wood it is essential to face with metal the parts that contact the metal loose piece. Fig. 2 shows two bosses which have to be loose in a corebox, and are carried on one dovetail-shaped piece, tapered to leave easily, and wide enough to allow the fillets round the bosses to be incorporated. To prevent wearing away the wood, metal is required on the two sides and the bottom, as shown in Fig. 3, while the back should be covered with metal or have two strips level with the wood as shown. It is good policy to cut the recess and place the metal on the surfaces where required before finally fitting the loose piece.

Another type of loose piece is shown in Fig. 4. This is a round facing at the end of an arm. To overcome the feather edge of the fillet a recess should be cut back as shown. Providing ample space is left for the withdrawal of the loose piece, this metal facing should be carried on a dovetail, which should be cast on the loose facing; the sides of the dovetail will have to be cast square for moulding purposes, and the undercut required filed on afterwards. In this case the face against which the loose piece rubs is the only one requiring metal, and if the metal used is about ¼ in. thick, sufficient bearing will be given for the sides of the dovetail to slide against. The position of the metal pieces covering the surface against which the loose piece will slide is shown in Fig. 5.

B.C.I.R.A. NEW MEMBERS

The following concerns have been elected members of the British Cast Iron Research Association. The representative is given between brackets:—Darlington Railway Plant & Foundry Company, Limited, Darlington (Mr. J. Walton); Dorman, Long & Company, Limited, Middlesbrough (Mr. J. D. H. Hobson); Dorrator Iron Company, Limited, Falkirk (Mr. T. M. Scott); Thomas Green & Company, near Bilston (Mr. J. R. C. Brain); Guest, Keen & Nettlefolds, Limited, Cwmbran, Mon. (Mr. N. R. R. Brooke); Jennings Winch & Foundry Company, Limited, Sunderland (Mr. H. Jennings); Lion Foundry Company, Limited, Kirkintilloch (Mr. R. Dickson, J.P.); R. & A. Main, Limited, Falkirk and London (Major A. L. S. Wood); Richard Nevill & Company, Limited, London (Mr. E. Williams); Shaw & McInnes, Limited, Glasgow (Mr. P. H. Paul); J. & J. Siddons, Limited, West Bromwich (Mr. P. S. Houghton); Smith & Fawcett, Limited, Bradford (Mr. N. Smith); John Summers & Sons, Limited, Chester (Mr. Clive Hampton), and Walker Bros. (Wigan), Limited, Lancashire (Col. J. S. A. Walker).

The formal opening of the new premises will take place on May 28, and members will be sent full details in due course.

RADIOGRAPHY AS AN AID TO FOUNDRY TECHNIQUE

Gamma-Rays in the Routine Testing of High-Conductivity Copper-Alloy Castings

By W. GLADWELL

(*Continued from page* 8.)

Position of Feeders

Fig. 10 shows a casting with very varied section thicknesses. The tray is ¼ in. in thickness, the bearing walls are ½ in., four of the bolting-down bosses are 1½ in., and the connection between the bearing and the tray varies from 2 to 4 in. of metal. This casting was made in a nickel-silicon-copper alloy, of which the most notable features affecting the making of sand castings are the high liquid shrinkage, and a tendency to form an oxide dross during pouring. The obvious points at which to expect internal shrinkage were the bolting-down bosses and the rather heavy mass of metal between the bearing and the tray. The first casting made off this pattern was cast with the tray down, with metal denseners under the bosses, a large feeder running practically the whole length of the bearing, with a sprayed inlet at the lower portion of the mould. The result is shown in Fig. 11. This radiograph shows a large cavity in the metal joining the bearing to the tray. Experience had shown that the size and shape of the feeder were such as to take up the volume of liquid shrinkage likely to be encountered in this casting. It was therefore assumed that the fault must lie in the position of the feeder head. The fact that this was not directly in contact with the section to be fed, but connected to it by the walls of the bearing, raised the point as to whether there was sufficient metal in the walls to remain liquid long enough to allow the liquid metal from the feeder head to reach the thicker section connecting the bearing to the tray. The obvious way to prove this point was to mould the casting the other way up, thus allowing the feeder to be directly in contact with the heaviest section. With a similar weight of metal in the feeder, the casting was obtained quite sound, as is shown in Fig. 12.

FIG. 10.—CASTING IN NICKEL-SILICON-COPPER, HAVING VARYING SECTION THICKNESSES (*see* FIGS. 11 AND 12).

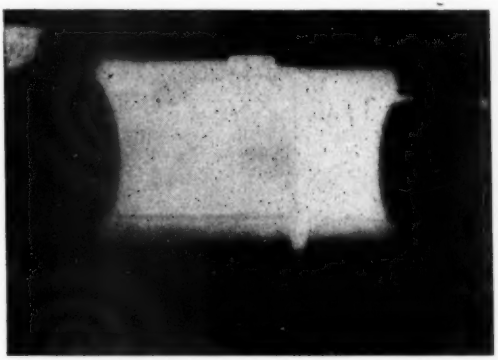

FIG. 11.—CAVITY IN THE CASTING OF FIG. 10.

Effect of External Denseners

Fig. 13 is a photograph of a casting with runner and riser, made in a chromium-silicon-copper alloy. The box-like end is in ¼-in. metal stiffened up to ¾ in. at one point, the bottom flange is ¾ in., in place of a top flange are six 1 in. dia., 1 in. thick bosses, and the protruding arm is 1¾ in. in dia. This example is chosen to show the practical use of external denseners, a subject which has been a bone of contention at many Institute meetings.

The first casting made off this pattern had denseners placed under the two bosses where the box joins the arm, the inlet sprays were relied upon to act as feeders to the two bosses with which they were connected, and a run-off riser was provided to cover the shrinkage in the arm. The two bosses formed in the core, and the thickening strip down the back were completely overlooked. When radiographed the resulting casting was shown to have defects in three of the bosses and the thickening strip. (See Figs. 14 and 14A.)

The second casting had denseners placed under all the bosses, and one in front of the thickening strip.

Gamma-Radiography in the Foundry

This meant carrying three denseners in the core, and to avoid deformation of the core in the green state by the weight of these denseners, carbon blocks were substituted for the usual metal ones. The result was as shown in Fig. 15. This casting appeared to bear out the argument that denseners only push the trouble somewhere else, since a porous area can be seen that did not appear in the first casting. E. Longden, in reply to the discussion on his Paper on "Liquid Shrinkage and Contraction," at Manchester, stated that this theory was fallacious. Denseners properly applied with due regard to their position, volume and thermal conductivity, and the changes they will make in the order of solidification of the various sections of a casting, will unquestionably prove him correct; but denseners used haphazardly, such as "Put a chill on that boss, Harry," with no regard to size, probably do lead to movement of porosity from one spot to another.

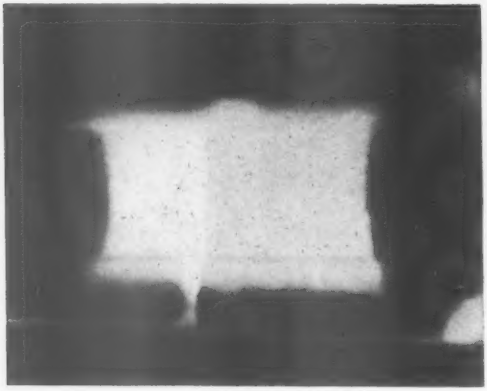

FIG. 12.—SOUND CASTING OF FIG. 10.

FIG. 13.—CASTING IN CHROMIUM-SILICON-COPPER WITH RUNNER AND RISER (*see* FIGS. 14, 15 AND 16).

When making the third casting off this pattern, it was decided to follow up the use of denseners, and a further one was placed under the bottom flange. This resulted in the sound casting shown in Fig. 16.

Fig. 17 is a radiograph of a two inch square sand-cast block, and is included in this Paper more as a curiosity. Cast on end and top poured, this block will be seen to have a pipe, which for some obscure reason does not follow the normal path of such defects in billets, that is, straight down the centre, but deflects towards the wall of the casting at one point. The only feasible explanation of this effect so far offered is that in pouring, the stream of metal must have been playing directly on the side of the mould at this point, and produced a hot spot which delayed solidification there. When this is considered

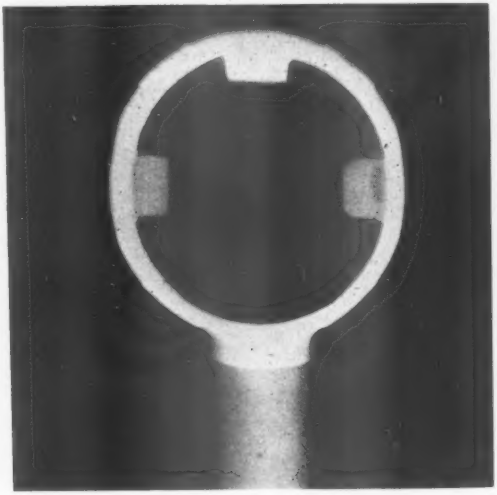

FIG. 14.—DEFECTS IN THREE BOSSES AND THE THICKENING STRIP OF THE CASTING SHOWN IN FIG. 13.

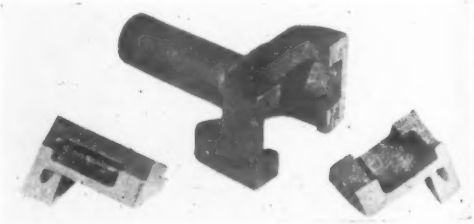

FIG. 14A.—CASTING SHOWN IN FIG. 14 CUT TO SHOW CAVITIES.

in relation to the fact that in recent years there has been a tendency to go over to top pouring for non-ferrous work, the value of the strainer cup recommended by many lecturers appears to be even more pronounced.

Radiography in Relation to Pressure Testing

Fig. 18 is a radiograph of a water-cooled electrode clamp, in which a small area of porosity can be seen in the thicker section of the metal between the water channels. This casting failed on test. Radiography used on work of this type, apart from its value to the foundry, can save many hours in the machine and

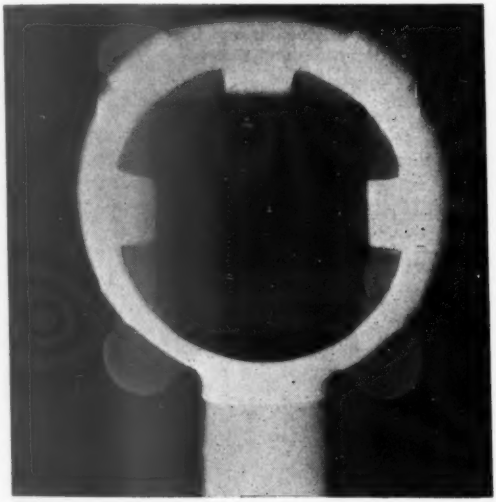

FIG. 15.—POROUS AREA IN WEB OF CASTING SHOWN IN FIG. 13.

pressure testing shops. The particular example shown is one of those exasperating jobs where, for no apparent reason, castings made under apparently similar conditions give erratic results in the test house.

Increasing the size of the feeder heads did not prevent this variation, since one casting with equal metal in the feeders to that in the casting was good. (see Fig. 19), whilst a casting with a ratio of three in the feeders to two in the casting failed on test. Reduction in pouring temperature did not prove to be the solution, but did lead to the most successful change made in production methods, which was to increase the pouring temperature. This gave more consistent results, though the final solution was found to lie in a change in the design of the water chamber.

This Paper was prepared in an attempt to indicate the manner in which radiography can be of assistance to a foundry. It is rather paradoxical that in

FIG. 17.—GAMMA-RAY RADIOGRAPH OF A TOP-POURED 2-IN. SQUARE BLOCK. THE PIPE IS DEFLECTED TOWARDS ONE WALL OF THE MOULD.

endeavouring to make this clear, emphasis has of necessity been placed on the radiographs of unsound castings. In deference to the foundry trade in general and to the shop concerned in particular, it must be made clear that this fact in no way implies that all new designs necessarily mean bad castings in the first instance.

The introduction of radiographic examination into a particular foundry brings into prominence the problem of what constitutes a good casting. It will be evident that some guide as to the flaws permissible will have to be drawn up for the assistance of the inspection department. No single standard could be fixed covering castings as far removed from one another as structural members of machine tools and Diesel cylinders, for obviously the use to which a casting will be put in actual service must govern the extent of the flaws permissible in that casting.

In conclusion, the author wishes to thank the directors of Mallory Metallurgical Products, Limited, for permission to present this Paper, and to use examples of their products, and Kodak, Limited, for permission to publish Fig. 3.

DISCUSSION AT LONDON MEETING

The BRANCH-PRESIDENT (Mr. R. B. Templeton), after commenting on the great interest of the Paper, said he did not like very much the author's use of the word "cavity" when referring to defects which could be detected by means of radiography. The word "cavity" suggested a definite hole, and there was a very wide range of structure between a hole and a close-grained structure within which a casting might fail under pressure test. A cylinder head, for example, might not have an actual cavity inside it, but its grain structure might be so open at some point that it would fail under pressure test. He asked whether radiography would indicate this difference of structure and

Gamma-Radiography in the Foundry

make it sufficiently visible to the eye to enable one to decide whether or not the casting was quite sound everywhere.

Radiography was definitely of value from the quantity production point of view. If one were producing 3,000 to 5,000 of a certain casting, it would certainly pay to take a radiograph of the earlier samples, as one would be able to decide whether or not it was a border-line case. If the radiographs showed it was a border-line case and the moulding technique and the metal control were correct, then any slight variation in the metal control during the

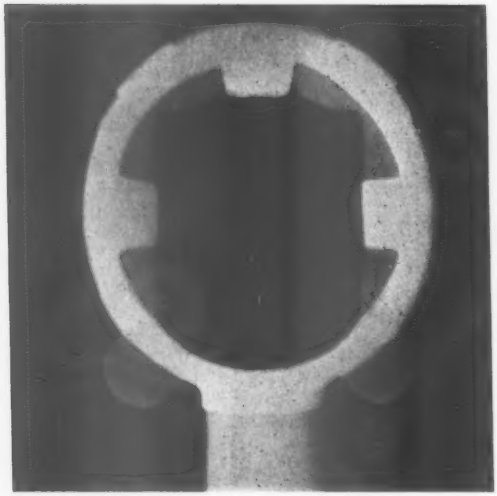

FIG. 16.—SOUND CASTING AS FIG. 13 OBTAINED BY USE OF DENSENERS.

subsequent production would probably render the production job a failure. If, on the other hand, the radiograph showed that the sample was sound, then one would have a margin to cover any subsequent variation in the metal control or moulding technique. Apparently there was not quite so much advantage in the use of radiography in connection with jobbing work, except where one had to produce a special casting; and he asked if Mr. Gladwell would agree that in such a case it would be necessary to take a whole series of radiographs of the casting.

MR. GLADWELL replied that perhaps he had made use of the word "cavity" because he was concerned with non-ferrous castings; non-ferrous castings sometimes had cavities, and those cavities were inside; they might be due to casting conditions or to shrinkage. Further, castings in high-shrinkage ferrous metals sometimes looked quite well on the outside, but there were cavities inside. Manganese bronze castings very often showed a draw on the outside, but the high-copper-content alloys did not exhibit that feature to the same extent. As to whether radiography would enable one to see the grain structure sufficiently to be able to decide that it was just sufficiently unsound to warrant the scrapping of the casting, Mr. Gladwell said that, given an even-section casting, good illumination and a good viewing screen, the radiograph ought to show the change in density of the metal.

MR. R. L. DURANT (of the Radiography Department of Johnson & Matthey, Limited), dealing with the Branch-President's question concerning the use of radiography in production foundries, said that the light alloy interests had done a good job in working out the best method of using radiography in production, and they had been using it for quite a long while.

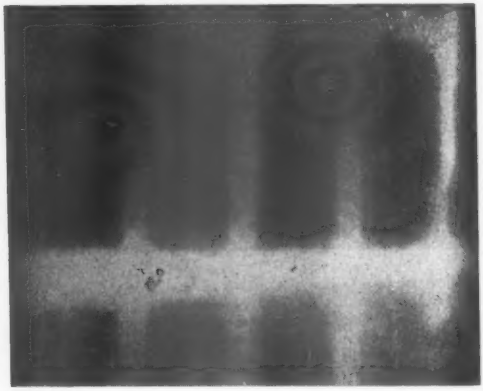

FIG. 18.—A GAMMA-RAY RADIOGRAPH OF A WATER-COOLED ELECTRODE CLAMP SHOWING POROSITY IN THE THICKER SECTION BETWEEN THE WATER PASSAGES.

The value of radiography in a jobbing foundry must depend on the type of work that was being done.

Acceptance or Control Test?

MR. V. C. FAULKNER (Past-President of the Institute and of the London Branch, and Hon. Secretary of the Branch) was still convinced, after having heard Mr. Gladwell's Paper, and many others previously, that the use of radiographic pictures for the purposes of an acceptance test was undesirable. That view was held by the Railway Companies and by most of the inspecting authorities. At the moment, far too much depended on the interpretation of the pictures, and he still regarded it as solely a control test. At the same time, the use of radiography had been developed to a great extent in the light alloy industry, so much so

that the castings were brought to the viewing screens by conveyor.

MR. GLADWELL replied that his firm had decided to use radiography because they were tackling alloys to which they were not then accustomed, and had to make good castings in those alloys. Although, before the use of radiography, he had thought that the castings were good, he had cut up some of them and had found that they were not so good as they should be; indeed, it had been suggested, perhaps facetiously, that he had been making those castings for three months before he had been able to make a good one. Radiography was adopted because of the initial troubles, and since its adoption some good castings had been made. He would not discuss as to whether

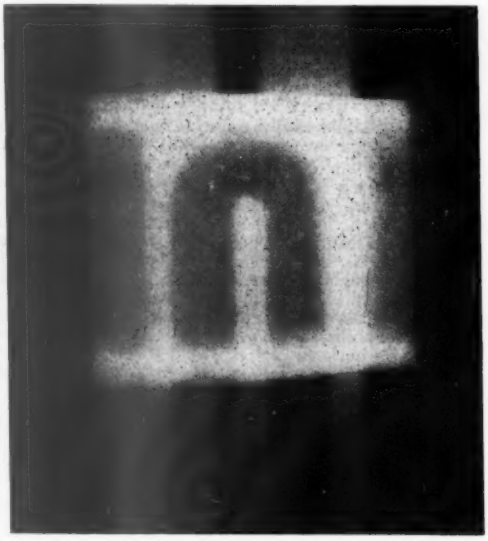

FIG. 19.—SOUND CASTING OF FIG. 18 TYPE.

or not an authority such as Lloyds should use radiography as an acceptance test; but the A.I.D. had a radiographic test for castings, and certainly the A.I.D. wanted good castings. He was not out to claim that radiography provided the finest acceptance test, but that it was a valuable medium of assistance to foundrymen. Too often foundrymen in the past had complained that, although there was a laboratory stuck on the end of the foundry, all the reports on castings went there and stayed there, and probably the foundrymen never saw them. He had been told that 50 firms in this country were using radiography; and he urged that the radiography department should always inform the foundry whenever radiography showed that a casting was not all that it should be. Only in that way could the foundrymen be expected to put matters right, and they were willing to take advantage of it, if it were used to assist them and not merely as a means to enable someone else to blame them and scrap their castings.

"Shadowgraphs"

MR. J. F. KAYSER urged that radiography was so important to foundrymen that the Institute would not be overdoing it if, say, 25 per cent. of the Papers presented during the next two or three years were devoted to that subject. It was interesting to note that apparently Mr. Faulkner, in his capacity as Editor of THE FOUNDRY TRADE JOURNAL, was tending that way, because quite a lot of the articles he was publishing dealt with the use of X-rays. It was not necessary for foundrymen to know very much about the apparatus itself; he did not think it was necessary for the foundrymen to know more about the X-ray apparatus than one should know about a camera for the purpose of taking good photographs. That did not imply, of course, that the user of X-rays should be downright ignorant about the apparatus; but it was rather unfortunate that many who had discussed the application of X-rays in the past had devoted far too much time to a consideration of the electric circuits, the particular types of condensers they used, the cooling systems, etc. The foundrymen did not need to be troubled with that sort of thing, but wanted merely a piece of apparatus which would produce shadowgraphs of their castings. Incidentally, the whole problem was much simpler if one regarded the pictures simply as shadowgraphs, instead of "radiographs."

In a criticism of some of the shadowgraphs exhibited, Mr. Kayser suggested respectfully that those responsible for them had not chosen quite the best angle from which to "shoot" them. In general, he said, one could not obtain much information from what might be called a "normal shot." For instance, using an ordinary chair with which to illustrate the point, he said the most useful shot would not be one taken straight down through the seat or straight across it, because one would experience trouble in dealing with the angles and corners; it was necessary to take the picture at an angle of 45 deg. or thereabouts. It was really very important to select the right angle for each shape of casting. Some of the shadowgraphs exhibited seemed to be inconclusive; the radiographers had attacked one part of a casting, but had not attacked what he believed to be the real danger zone.

Care must be exercised to ensure that progress was made along the best lines in developing X-rays for use in the foundry, because, although X-rays had been known for a very long time—he believed the first X-ray tubes were made in 1896—the science was, in a way, still in its infancy. The nomenclature also must be definite. When referring to the "screen," the fluorescent screen or intensifying screen was indicated, as distinct from a sheet of lead which was used to screen off the rays from the operators; it was usual nowadays to refer to the latter as a "filter."

(To be continued.)

BRITISH AND UNITED STATES STEEL SPECIFICATIONS

A very interesting and valuable publication has just been issued under reference No. B.S. 1111, Summary of British and American Standard specifications for iron and steels. The number of specifications for steel products is now considerable, particularly when account is taken of the specifications in the British Standard Aircraft series and those in the D.T.D. series of the Ministry of Aircraft Production. A user requiring information as to whether a specification exists for a particular steel would at the present time have to consult a large number of publications before he would be able to find out whether there is a specification which provides for the particular steel he requires. There has, therefore, been a growing need for a tabulated summary which would set out the details of the various specifications in a single publication. This need has now been met by the issue of the publication referred to above.

It includes details of the chemical composition and also the mechanical properties of all British Standard specifications for iron and steel and also the Ministry of Aircraft D.T.D. specifications. The foreword makes quite clear that the summary is intended for reference purposes only. It does not cover such points as the number of tests to be taken, the procedure to be followed if the first test fails, and other essential requirements that have to be laid down in a specification. The appropriate specification should always be used when ordering material. The usefulness of the summary has been greatly increased by the inclusion of details of American steels. These are of considerable importance with the deliveries of steel that are made from the U.S.A. The summary includes details of the full range of steels covered by the S.A.E. series (Society of Automotive Engineers), the A.M.S. series (Aeronautical Material Specifications) and the N.E. series (National Emergency Steels).

The selection of steels from the A.S.T.M. and the Federal series has been made in accordance with the latest recommendations of the U.S. War Production Board.

AMERICAN BLAST-FURNACE TRENDS

The standard tonnage for the 1942 model of blast furnace in the United States was definitely set at 1,200 tons per day, which is an increase of 20 per cent. over the standard of 1,000 tons per day as established in April, 1930, by the Blast Furnace and Coke Association of the Chicago District, says R. H. Sweetser in a review for 1942 in "Steel." Lines of these big furnaces are so proportioned that the right volume of blast can be blown without undue gas velocities at the stockline and the consequent heavy flue-dust loss. The stockline-hearth diameter ratio was too small in 1930. Several furnaces already have made much more than 1,200 tons per day over several months at a time; thus the October record of "H" furnace, Lackawanna Works, Bethlehem Steel Company, was 46,246 tons, or 1,941 tons per day.

Besides building a properly-designed blast furnace that can take wind enough to burn the requisite amount of coke, there have been concerted efforts to improve the quality of coke in characteristics other than in simply eliminating excess ash in the coking coal. More attention has been given to increasing the richness of the ore mixture by using more sinter, and especially sintered magnetic concentrates. Mixing of fine limestone with the ore and flue dust fed to the sintering machine has helped to increase the output. Some low coke consumption records have been made—less than 1,200 lbs. of coke per short ton of pig-iron. The use of beneficiated air blast has increased during the past year. It has been found that the 3 grains of moisture per cub. ft. of blast is better, in most cases, than only 1 grain, but even 3 grains may not be the optimum.

PUBLICATIONS RECEIVED

A Select Bibliography on Management and Labour. Published as Research Bulletin No. 7 by the Sheffield City Libraries.

It is a pity that this bibliography only starts at 1932, because some of the pioneer publications made during the period 1914-17 are much more interesting than the more modern articles, which are often merely amplifications and confirmations of the original researches. Especially does this refer to the full utilisation of rest pauses. The ground covered, however, is very extensive and a really useful purpose has been served. There are 45 pages of annotated references, and it is unfortunate that paper restrictions have limited its free distribution to large works and research organisations to the exclusion of the individual.

Technique for the Gas Welding of Copper. Published by the Institute of Welding, 2, Buckingham Palace Gardens, London, S.W.1. Price 2s. 6d. post free.

The excellent report has been prepared by a subcommittee of the Institute of Welding presided over by Dr. Maurice Cook. The properties of copper as related to welding are detailed and this is followed by a study of the practice of welding including that of hammering. Finally, the fettling of the weld is dealt with, and the pamphlet closes with some fine illustrations of typical large-scale jobs which have been fabricated by welding.

Shortage of Moulders in Germany.—At a recent branch meeting of the Verein deutscher Giessereifachleute, attention was called to the shortage of moulders in Germany and the difficulty in finding apprentices. To stimulate interest in moulding a film is being produced showing steps in the training of moulders and ordinary moulding operations. Various foundries are organising training workshops and instituting graded courses for new entrants into the industry.

INTRODUCTION OF FEMALE LABOUR INTO THE FOUNDRY*

By W. JONES

Female labour is fast becoming a regular practice in all repetition foundries. Women have proved themselves to be as satisfactory as men, and, in quite a number of cases, better. Let it be therefore imagined that there is no female labour at all in the foundry, but that women are about to be employed. It is known from past experience that all clerical work, and progress of all orders throughout the foundry, can be well attended to by girls or older women.

At the very beginning of foundry operations is the mixing of sand. Using mixers that are filled by hoppers, there should not be much difficulty in changing over to female labour; on other sand-mills it is quite easy, by slight modifications to existing plant and equipment, to take the weight factor out of the job, thus allowing it to be done by women.

Moulding machines can also be operated by women. One method that can be adopted is to arrange the height of the conveyor so that boxes can be pushed off the machine straight on to the mould conveyor, and thus, by eliminating the lifting, it is usually possible to employ female labour in this direction. As to coremaking, it has been found that girls take to this job very quickly. They have been found to be more adaptable and more nimble in ramming cores, and they are not subject to boredom quite so easily as men. This is a point well worth explaining further:—A corebox was given to a girl, and she made the same core continuously without a break for two months; the same corebox given to a man, after one week's time, he was fed up with the sight of it. Once again it is necessary to give a little more time and study to layout and plant. In the author's case, the plant uses iron and wooden coreboxes, all of which are two- or three-parted boxes. Cores are made on a bench, the girls working on each end of the bench; the cores are turned over on to aluminium drying plates, and by turning round the girls can put the finished core on to the core conveyor; this then continues round to the back of the stove, where a girl can load on to the continuous stove; the conveyor then continues round the side of the stove, so that after taking the baked cores off the front, plates can be put on the conveyor and returned to the girls, thus eliminating a great deal of walking about.

The core sand has been arranged in four different types, soft, medium, semi-stiff, and stiff. By the use of the correct sand, the management is able to do away with sprigs, wires, irons, etc. This also is very suitable for production, and more satisfactory to the girls, who do not like any intricate wiring, venting or finishing. They would rather have a plain straightforward job, which is different from the men, who like to do a bit of finishing.

* A prize winning entry in a competition organised by the West Riding of Yorkshire Branch of the Institute of British Foundrymen.

Layout for Female Labour

Core-dressing in this foundry is also done by women and girls, and it has been found to be quite successful. The layout in this particular case has been arranged so that the benches form a letter "E," the back of the "E" receiving the cores from the stove. The girls sitting on the other side dress the cores, and pass them down the legs of the "E" where they are blacked, and then passed over to the inspection bench. After inspection, they are placed in the lockers behind the bench. These lockers are situated next to the moulding machines, and the girl core-setter has then only to take the cores from the locker, and place them in the moulds which are passing in front of her on the roller conveyor.

After casting, the castings are taken into the fettling shop, and "wheelabrated." From there, they can be ground by female labour, passing along to the inspection bench where women fettle the castings. The castings are then passed down into the stores, ready for despatch to the machine shop for finishing. Women can also act as storekeepers. For delivery to the machine shop of pistons, a small Lister truck is used, which is driven by a woman.

Sand testing, sample block collecting, and quite a good number of other jobs, can be done by girls in the laboratory. This, however, entails more scientific training, thus calling for a better educated girl. Other jobs done by girls and women in this foundry include crane driving, weighing of additions, lathe operators, testing machines such as the Brinell, etc., marking castings for identification, supplying moulders with cores and runners, making runner bushes, and light manual work. Usually the only objections to working in the foundry are the fumes and the heavy lifting. By careful planning, however, the heavy lifting can usually be eliminated, and the best cure for the fumes is the one suggested by Mr. Gardom, "take them into some other foundry and they will be glad to work in their own." Where females are employed, better sanitary and washing arrangements should be made than is usual in the foundry. The alterations to equipment entailed, and the new parts put in, are usually to advantage. There should be a higher production which will pay for all the trouble.

Foundry managements should realise that in many cases women workers have to run a home, and attend to small children, and in consequence a sympathetic approach should be made to their shopping problems, etc. Provision should be made for them to finish work in ample time for them to attend to their household duties on wage nights, and excessive overtime should not be demanded. Consideration of this kind and also of general welfare will be more than repaid by enthusiasm on their part.

Discussion

MR. W. G. THORNTON, opening the discussion, said he could hardly agree with everything the author had said in regard to female labour, but there was no doubt there were phases of foundry work in which women were handy and useful. They were of two kinds—those who intended to take an interest and

Female Labour in the Foundry

make progress and those who just went on week in and week out with what was put before them. In these respects they were not materially different from male labour. At the moment he had half-a-dozen girls plate moulding, and at that type of work they could beat the men. On the other hand, there is the type of girl who will operate a machine and will keep on at that and nothing else. Girls were more careful with core blocks and tackle than most men.

MR. H. FORREST said he confirmed Mr. Jones's observations as to some of the women coremakers. They certainly did not seem to suffer from boredom at this work so much as men, and that was borne out in the machine jobs. One trouble was that a girl who did a job very well, and with much interest, may leave to get married, and it may not be easy to get another girl to do the work so well. People were not made to exact patterns, whether men or women, and one had to utilise the labour one got to the best advantage possible.

Girl Moulders

MR. F. K. NEATH, B.Sc., said at his works they had had girls coremaking for a long time and found them very adaptable and patient. If given proper instructions, they would carry on at a given job, often much more carefully than many of the men. Coremaking was a job which lent itself very well to female labour. When it came to moulding, there was no doubt that with good instruction and a little selection, women could be found who would carry on moulding more systematically and even more scientifically than many men. Lifting, of course, was generally regarded as hardly a job for the women, but even in this case he had found that, if the job could be arranged at a level which did not call for bending by the girls, the difficulty could be overcome. The idea was to have the conveyor at the same level as the machine so that the girls did not have to bend to tackle the lift.

He had had success also where a girl had not been satisfactory at one job, but had been found quite good when transferred to some other job better suited to her. Shovelling of sand is hardly a job for women, but they had a very nice sense of judgment and delicacy of touch in such work as crane and truck driving.

MR. THORNTON said, in the case of a pattern-drawing job, it was found that two men were not doing it well, so two quite new girls were tried, and they did it very well indeed by doing a bit of thinking for themselves, which the men did not seem capable of doing.

MR. WOOD said female labour in the foundry was not at all new. He had seen girls by the hundred in coreshop work as long as 30 years ago. In his own recollection he had six girls or so making some 20,000 cores per week. The employment of female labour was by no means merely a feature of foundry life in wartime.

The AUTHOR pointed out that the fact remains that under war conditions the management had to introduce female labour into a good many jobs they had not been called upon to do previously and had found them to be a very satisfactory form of labour at those jobs.

Superior as Core-makers

MR. H. FORREST said in the foundry to which the author referred, women had been employed as coremakers for 15 or 20 years. The point the author was making was that a large number of foundries still declined to realise the value of this female labour even in times like the present. There were many jobs in the foundry which could be done by female labour with entire satisfaction. In normal times, he agreed, there were few people in the industry who would wish to replace men by women in the foundry. Women should have no place in peacetime as labourers, but there were jobs at which they would excel at any time and core-making was certainly one of them.

The PRESIDENT (Mr. F. Oldershaw) said it was not a case of introducing women into the foundry as an industrial development, but as an emergency need. It had not been necessary to introduce female labour because the youths were available, but that was not so to-day.

MR. THORNTON said the argument reduced itself to a matter of locality and local needs. In this area there was a great deal of employment for women in other industries but to-day girls were doing a really good job of work in certain foundry tasks and we ought to be thankful to them.

MR. BLAKISTON said women were specially adaptable to labour-saving devices, but it must be recognised that these devices, whatever the reason of their introduction under war conditions, were in themselves a help in production and would continue to be so.

NEW PLASTIC-TREATED PAPER

Plastic compositions which may be substituted for steel or other metals in some uses can now be manufactured by incorporating with various cellulosic fibres a resin powder known as Vinsol, extracted by Hercules Powder Company from the southern pine tree. This new structural resin plastic is a thermoplastic, fibrous-resin composition, hard, dense, stiff, but with reasonable toughness. It is said to be a possible replacement for steel or other scarce metals for some parts in food containers; for licence plates; in trucks, street cars and buses; conduits in certain uses; cement-filled columns supporting light loads. The Federal Electric Company, Chicago, for some time has been manufacturing "Fedralite" for commercial use as a 3 in. dia. plastic tubing to replace steel pipe for shot-hole casing in seismograph oil-field exploration work. Several other companies are working on adaptations of various kinds, such as containers for greases and oils, lightweight structural I, U, and L or similar members, pipe wall panels, corrugated sheets, air-conditioning ducts, vent pipes, fluorescent lighting fixtures, etc.

NON-FERROUS CASTING TECHNIQUES

A SUMMARY OF RELATIVE CHARACTERISTICS

Table I, prepared by the General Electric Schenectady works laboratory, shows in handy form a comparison of the advantages and disadvantages of various casting methods for non-ferrous metals. Sand castings are still the most common form of non-ferrous castings, requiring the lowest cost of tools and the shortest time to get into production. However, they require more direct labour in both foundry and machine shop, and are more variable in structural density and physical properties than metal mould or plaster of paris castings.

Castings made in plaster of paris moulds offer as good surface appearance, sharp outlines and approximately the same tolerances as metal mould castings, at considerably lower "tool" cost. They are more competitive against brass and bronze metal mould castings than against aluminium. Due to the low thermal conductivity of plaster of paris, castings can be made much thinner than in sand or even in metal moulds. There is less danger of internal porosity than in sand castings, but the structural strength is lower.

Due to the closer tolerances and good surface of metal mould castings, they generally obviate the expensive machining operations necessary with sand castings, except for very close tolerances. Gravity die castings are characterised by a dense, fine grained structure, free from shrink holes or blowholes. However, it is not possible to maintain as close tolerances and to cast sections as thin as in die castings or plaster of paris castings. Although applicable to zinc, aluminium and magnesium alloys as well as certain bronzes (and cast iron), the process is not particularly suitable to yellow brasses high in zinc on account of the zinc oxide fouling the metal dies.

Pressure die castings, whether made by a gooseneck machine or a cold chamber machine, are characterised by sharp outlines and contours, fine, smooth surface and high speed of production with low labour cost. They all have a hard skin with a softer core, due to rapid chilling of the surface of the casting from the metal mould. Consequently, machining of the surface will disproportionately reduce the strength of the section, and will cause warping due to the release of internal stresses held in check by the skin as long as it is unbroken. It will also reduce the leakage resistance against internal pressure. Machining deeper than 0.010 in. maximum is not recommended. When exposed to high temperature, pressure die castings are all likely to blister on the surface, due to the expansion of gases trapped inside the casting by the rapidly hardening skin before they had a chance to get out.

Again due to the rapid chilling and the resulting fine grain size of the structure, they all have greater strength than the same composition cast by any other means, although it is difficult to avoid occasional internal porosity, especially in heavier sections.

TABLE I.—*Relative Characteristics of Different Casting Methods for Non-Ferrous Metals. (Numbered in order of preference thus 1 indicates first preference, 2 is second choice, etc.).*

Casting process.	Sand.	Plaster of paris.	Centrifugal.	Gravity die.	Pressure die.	Cold-chamber pressure
Porosity	6	2–1	1–2*	3–4†	5	4–3
Surface	6	1	5–4*	4–5†	2–3	3–2
Sharpness of outline tolerances	6	3	4–5*	5–4†	2	1
Strength (solid metal)	5–6	6–5	3*	4†	2–1	1–2
Thin sections	5	1	6	4	3–2	2–3
Tool cost‡ (pattern or moulds)	1	3	2	4	5–6	6–5
Speed of production and labour cost per casting	On basis of most economical tool setup (as to number of impressions on one pattern plate or in one die) for comparative production quantities.					
	For small and moderate production, including setting up of die. 1	2	4	3	5–6	6–5
	For large production: 5	6	4	3	1–2	2–1
Possibility to save machining	6–5§	3	5–6§	4	2–1	1–2

* In metal left after removal of drossy material from inside of wall.

† Only in material next to metal mould in case of semi-permanent moulds.

‡ Tool cost and cost per casting depend on number of patterns per plate or impressions in die; the more castings can be made at one operation, the lower the labour cost per piece, with inversely increasing tool cost. Sand and plaster of paris moulds lend themselves more economically to multi-impressions than metal moulds.

§ May be reversed in certain cases.

Non-Ferrous Casting Techniques

In the gooseneck type of pressure die casting machine, the cast-iron gooseneck which dips the molten metal out of the metal container and transfers it to the die is constantly immersed in the molten metal. When die casting aluminium, there is a strong attack of the aluminium on the iron in the gooseneck and metal container, with the result that the aluminium gradually absorbs an unduly heavy amount of iron, which affects its ductility, castability, machinability, shock resistance, etc.

Cold-Chamber Machines

In the cold-chamber machine, on the other hand, the metal container is separate from the rest of the machine. A hand ladle dips enough for one shot out of the container, and the pouring well is charged only with the contents of the ladle. Between shots, neither ladle nor pouring well is in contact with molten metal. For this reason, it is much easier to hold the iron content down.

The other chief difference lies in the velocity of the metal stream as it fills the die, and the pressure on the metal when the die is completely filled. Pressure on the metal and velocity of the metal stream are interrelated. In the gooseneck machine, the pressure is limited by the mechanical strength of the cast-iron gooseneck at the temperature imparted by the molten aluminium (around 700 deg. C.), 700 lbs. per sq. in. being as high as is safe. In cold-chamber pressure-casting machines, there is practically no limitation, pressures as high as 16,000 or even 20,000 lbs. per sq. in. being employed in some cases. Usually, however, lower pressures, on the order of 3,000 to 10,000 lbs. per sq. in., are used to facilitate the mechanical problem of making the machine heavy enough to provide the locking and holding power to keep the two die halves together under the tremendous impact of the injected metal.

Cold-chamber pressure castings hold out greater promise of solid, dense structure, sharp outline, and extremely thin section than gooseneck castings, but these results cannot be obtained unless dies are most carefully vented and gated. Due to their uncertain structural condition, gooseneck castings should never be used in any application which bears serious responsibility for maintenance of service or protection against trouble. Cold-chamber pressure castings may be used if expert care has been expended on mould design.

There is another important difference between the ordinary die-casting machines (both piston and gooseneck) and the cold-chamber machines, in that the casting mechanism of the die-casting machines is constantly immersed in the hot molten metal, whereas in cold-chamber pressure machines it is immersed only for short, intermittent periods. As a result, neither the standard piston nor gooseneck machines can be used for the higher melting point alloys, like brasses and bronzes, whereas cold-chamber pressure machines can be.

Cold-chamber, pressure-cast brasses and bronzes, however, have not yet found the same wide popularity as die castings or cold-chamber pressure castings in zinc and aluminium, although excellent products have been turned out. The main difficulty lies in the high cost of the dies, since the tool steel industry has not yet been able to produce a steel for the dies which will last as long against the high temperature at which the cuprous alloys are cast as die steels for aluminium or zinc. Plaster of paris or gravity die mould castings are still competing favourably with cold-chamber pressure cast brass or bronze, except where production is so large and saving in machining due to the closer tolerances so considerable that the high cost of moulds for the cold-chamber pressure castings can be absorbed.—"The Iron Age."

BENTONITE

At a meeting of the Yorkshire Section of the Society of Chemical Industry, Dr. A. L. Roberts read a Paper on bentonite, pointing out that clays are composed essentially of a number of minerals which can be classified broadly into three main groups. Bentonite consisted of minerals of the montmorillonite group. After briefly describing the layer lattice crystal structure of these minerals, he said that the attractive forces between the unit cells forming the crystal were relatively weak, so that water molecules and hydrated ions could readily penetrate the lattice, which underwent considerable expansion as a result. This penetration also caused breakdown of the crystals to particles of colloidal dimensions, with a corresponding large increase in surface area. The characteristic feature of bentonite in forming a stable gel of high binding strength when mixed with water was due to these fundamental properties of the principal constituent mineral.

In the ceramic and allied industries, bentonite thus provided a valuable means of obtaining plasticity, workability, and wet and dry strength in materials otherwise lacking in these requirements. For the same reasons, bentonite was an important constituent of synthetic sands used in ferrous foundry practice. Sufficient workability in a non-plastic material could frequently be obtained by the addition of as little as 1 per cent. of bentonite. Unfortunately, bentonite is relatively rare and costly, and one of the present day researches in this country is to discover indigenous sources of supply. Its attempted synthesis from aluminium hydroxide and silica had indeed produced bentonite, but almost every other clay mineral had been produced at the same time.

Stove Manufacture in the United States.—The unrestricted use of iron and steel in the manufacture of coal and wood burning heating stoves was permitted during February and March under an amended order in the United States, to speed up conversions from oil to solid fuel-heating equipment and to take care of the normal seasonal demand for stoves.

WEST YORKS SPECIMEN CASTING

V.—HOW SCIENCE COULD ASSIST IN THE PRODUCTION OF THE CASTING

By DOUGLAS JEPSON, M.Sc.

This was the fifth and final Paper devoted to the production of the cast-iron Diesel engine valve bonnet, otherwise known as the "Specimen Casting," designed for the purpose by Mr. Forrest and Mr. Thornton. The mould making, core making, metal required, and the defects to be guarded against were considered at previous meetings, and the subject of the last session was "How Science Could Assist in the Production of the Specimen Casting."*

Definition of Science

Opening his contribution, Mr. Jepson asked: "What is science? What is the nature of this assistant, now to be called into action? The dictionary definition of science is 'knowledge; or knowledge reduced to a system.' So it is systematised knowledge which is to be considered. Note that the source of the knowledge is not specified. It may come from practical experience, or from study, or, which is preferable, from a combination of the two."

How Science has Already Assisted.—Obviously, science has already assisted throughout the entire series of discussions. More than that, science assisted before the first Paper was presented. It assisted Mr. Wise to develop his idea of the presentation of such a series of Papers. It assisted Mr. Forrest and Mr. Thornton to design this casting, not only as a casting for such a purpose ought to be designed, but also as it ought not. Again, they in turn fell back on the scientific work of the British Standards Institution and other bodies, in drawing up the specification, as is exemplified by their quotation of B.S.S. No. 786, Grade 2. So far as the previous Papers have been concerned, everybody must appreciate that science assisted their authors in no uncertain measure. This assistant was thus by no means a newcomer.

How Science Might Assist Further.—It is desirable to take another look at the drawing and specification to see what are the outstanding points which may have been overlooked, or left for the author to deal with, or which might, with advantage, be reviewed.

Distortion

The centre portion of the casting is relatively heavy, but there is not an extraordinary variation in thickness of metal to give rise to contraction stresses and to lead to distortion. With a view to possible distortion, however, there is a number of sharp changes of section—although in reality not a great number. These sharp corners will become "stress raisers," that is, there will be concentration of stress there, and one might ask the designers whether any of these might be radiused off. If the designers agree, that will be of help, and, if they do not, the foundrymen will have advised them if trouble develops in consequence, so that will be of help, too. Moreover, will it not be advisable to uncover the internal portion, when solid, so as to allow it to cool and contract at the same rate as the outside? Or should the stresses set up be released by annealing the casting for, say, two hours at 500 to 550 deg. C., after carrying out the specified machining, and then true up again?

Growth

Growth is due to carbide breaking down to iron and graphite of greater volume than the original carbide, and to the penetration of oxidising gases via the graphite flakes, with consequent oxidation of the metal. To minimise it, the carbide should be low, the graphite flakes as fine as possible, and the metal rendered less oxidisable by the addition of alloying elements. Fine, evenly distributed, graphite is also necessary to improve the mechanical properties and to increase corrosion resistance. The production of the graphite in this form, therefore, is of first importance. There are several ways in which it might be done. Sufficiently rapid cooling will produce fine graphite, but there is not much margin between the rate which will do this and the rate at which no graphite will be produced at all, so that this procedure is not controllable. Then there is the removal or the prevention of formation of silica or silicate inclusions which act as nuclei and cause the graphite to be coarse. Whether this theory be correct or not, the fact remains that the desired result is achieved by taking appropriate steps to avoid silicon or its oxidation. Thus, fine graphite is obtained by promoting graphitisation by elements other than silicon, for example, by, say, 1.5 per cent. nickel in place of 0.5 per cent. silicon. This is expensive, however, and the cost is possibly not warranted for a No. 786 Grade 2 casting. A considerable charge of steel may be made in the cupola. Oxidation of the silicon may be avoided by melting *in vacuo*. Coagulation of silicate inclusions may be achieved by superheating to 1,500 deg. C. Again, fine graphite results if 1 per cent. of sodium carbonate is placed in the bottom of the ladle, due apparently to the agitation of the metal by the carbon dioxide evolved, whilst at the same time desulphurisation, with some removal of gases and non-metallic inclusions, takes place.

Minimisation of distortion due to contraction stresses, and of growth, would seem to be achieved by the Lanz Perlit process. This consists in casting the metal of pre-determined composition at a suitable temperature into a heated mould, using a low silicon iron. In the thicker sections the effect of heat from the mould walls is less than in the thinner sections, resulting in uniform cooling and thereby in a uniform structure which would be of the type required.

Lastly, there is the process of "inoculation"—not a very good term—whereby a graphitising compound such as calcium silicide (Meehanite iron) or ferro-silicon and F nickel shot (Ni-Tensyl iron) is added to the ladle. Normally, the iron would cast white or mottled, but the addition results in fine graphite dis-

* See FOUNDRY TRADE JOURNAL for January 22, February 19, April 23 and August 6, 1942.

tributed throughout a pearlite matrix. This method is being actively pursued in America, where various inoculating agents have been evolved, some proprietary, as, for instance, "Vitamin B."

Testing

The testing of the test-pieces called for by the specification is standard practice; but the point to bear in mind is that the results apply to the metal from which the casting has been made, and not to the various parts of the casting itself.

Tests on the casting may be divided into (*a*) non-destructive tests, by which the casting is preserved, and (*b*) destructive tests, involving its destruction.

Of the non-destructive tests, apart from ordinary visual examination, minute cracks may be discovered by means of the magnetic crack detector. The casting is placed in a magnetic field, and sprayed with a suspension of fine iron filings in paraffin, whereupon any cracks are indicated by the collection of filings along their edges.

Cavities and internal flaws may be discovered by X-rays, their presence being revealed on a photographic plate. This is a method of testing certain of development. It is in considerable use for steel castings, but, on account of cost not apparently very much for cast iron as yet. At the same time, arrangements for having the specimen casting X-rayed could be made at a reasonable fee.

Then there is the porosity test, first to be applied to the valve spindle guide portion and then the shell. After machining, the lower end would be plugged, the outside surface whitewashed and the interior filled with paraffin. It would be allowed to stand for a few hours and then the whitened surface examined for signs of seepage. If none was visible, pressure would be applied, as called for by the specification, and the surface examined again.

Of the destructive tests, microscopic examination is, of course, the all-important one. Here, science has assisted in providing a polishing technique such that the prepared surface gives a truly representative structure. It has assisted, and is in process of assisting further, in defining what is to be understood by "fine" graphite, which, after all, is a relative term. The B.C.I.R.A., in collaboration with the I.B.F., have prepared typical examples of microstructures, whilst the A.S.T.M. and the A.F.A. are producing a standard for graphite form and size as a basic reference, on similar lines to the illustrated standards relating to grain size. This is very valuable assistance. The microsections require to be taken from representative positions, particularly across the valve spindle guide. Fine graphite in a fine pearlite matrix is the necessary structure to accord with the tensile strength required, although unfortunately this will lead to some growth if the temperature exceeds 450 deg. C. From a growth or creep point of view alone, a ferrite matrix would really be preferable.

Conclusion

In concluding, it is necessary to repeat that the assistance of science is not the prerogative of the laboratory. Systematised knowledge is required throughout, and for the best results to be achieved all interested parties must pool their knowledge and unselfishly co-operate. If they do this, approach the job scientifically, and apply their collective, variously obtained, knowledge in a scientific manner, there is every prospect that the result will be a first-class casting.

To prove the point, the author would like to see the production of this specimen casting carried out in fact. He would like to see a half section exhibited true to shape, free from scabs and holes and drawn places, together with a statement as to the procedure followed, analysis, and test results, and with photo-micrographs showing just the structure in fact that there ought to be in theory. That would be a fitting climax to this most interesting series of discussions.

INVERSE SEGREGATION AND INTERDENDRITIC FLOW

Some examples of extreme inverse segregation have been observed in an alloy of 50 per cent. iron and 50 per cent. copper by M. L. SAMUELS, A. R. ELSEA and K. GRUBE, and reported in a Paper read before the recent National Metals Congress of the American Society of Metals. The alloy in question has a very wide solidification range and freezes as two distinct structural constituents. Iron dendrites containing some copper in solid solution begin to form at about 2,625 deg. F., and the copper-rich phase does not solidify until the temperature has dropped to approximately 2,000 deg. F. A copper-rich skin on the lower outside surfaces of some castings was thought to have originated from interdendritic flow during the mushy stage. It was found possible, by reheating into the mushy range, to displace the low melting phase with other metals which are not miscible with iron in the molten state, such as silver or lead.

Other alloys which freeze over a wide range of temperature and which also solidify as two distinct constituents were investigated. Alloys of silver-nickel, silver-cobalt, beryllium-magnesium, aluminium-lead, iron-aluminium, and copper-lead were made. Reasoning from this evidence of interdendritic flow in alloys which solidify as two distinct constituents, it is suggested that inverse segregation in alloys such as the low-tin bronzes undoubtedly arises from interdendritic flow. Alloys which may ultimately show only one constituent must pass through a stage during solidification in which there are solid dendrites and connecting interdendritic channels filled with liquid rich in the lower melting constituent.

SAVE STILL MORE PAPER

BOOK REVIEW

Die-Casting for Engineers. Published by the New Jersey Zinc Company, 160, Front Street, New York City, U.S.A. (Price 1 dollar.)

The title of this book serves to stress the difference in nomenclature as between England and America for the subject covered is pressure die-casting. If gravity die-castings had been included then the title would have read "Permanent Moulds and Die-Castings." The anonymous author of the book includes, and rightly so, the castings made in cold chamber machines under quite high pressures. A useful table (No. I) is included in the section covering alloys for die-casting. This is designed to help the engineer to select the most suitable alloy for any given purpose. There are many excellent data given on the basic principles of die construction. As this is the prime factor governing the whole economics of the process, it is worth studying by all engaged in this section of the industry. Moreover, the section is reinforced by a further one on the design of die-castings. The fascination of die-castings is shown when finishes are dealt with. Herein are illustrations of button shanks weighing 250 to the ounce and zip fastener elements which are die-cast directly on to the cloth tape at the rate of several hundred per minute. In die-casting, the foundryman has a weapon which is sufficiently powerful not merely to hold jobs for his industry, but wrest a wide variety from competing trades. For instance, in contrast to the tiny components referred to above, there is an illustration of a penny in the slot machine measuring 36 in. × 9 in. × 8 in. carried out as a zinc alloy die-casting. Equally impressive is the radio chassis, with its many compartments and about fifty cored holes. It is a great pity that war conditions will prevent the wide circulation of this book in this country, for it is a very valuable contribution to a phase of foundry work about which reliable information is still scarce. V. C. F.

AJAX FURNACES

Ajax Electric Company, Inc., Philadelphia, Pa., has installed several hundred deep-case carburising furnaces. During the past six years more than 100,000 kw. electric capacity of Ajax-Hultgren furnaces have been installed. The new Ajax furnace holds temperatures constant within 5 deg. at approximately 1,750 deg. F., as required in the new deep-case operation, this is by using the electromagnetic effect between pairs of closely-spaced electrodes. Ajax furnaces are of the resistance type, the molten heat treating salt itself being the conductor. The furnaces provide for case depths up to ¼ in. thick, and the method permits quenching directly from the bath, and transfer to bath is maintained at quenching temperature, thus eliminating re-heating. This type of carburising is applicable to armour plate, tank gears, transmission parts, cams, and other parts requiring a strong surface. The furnaces are applicable for standard heat-treatments between 350 and 2,400 deg. F.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s each.

551,353 ZUBLIN, J. Rolling of magnesium and the alloys thereof.

551,359 EVANS, W. E. (Climax Molybdenum Company). Processes for the production of molybdenum-containing alloys.

551,372 WILLIAMS, J. H. V. Manufacture of iron and iron alloys.

551,393 EVANS, T. Brushes or wipers for the rolls of tinning apparatus.

551,427 SERCK RADIATORS, LIMITED, and GARNER, E. Shaping of thin metal tubes.

551,448 GRAY, C. A., and KOOPMAN, J. M. Work holders for use in drilling and like operations performed on rod, bar, strip, or like material.

551,559 FRASER & FRASER, LIMITED, and PARTISCH, K. J. A. Degreasing of metal and other non-porous articles.

551,636 BRITISH CELANESE, LIMITED. Treatment of carbonised steel alloy surfaces to remove carbonaceous material therefrom.

551,668 BAKER, T. T., and GORDON, F. E. Treatment of steel wool for the prevention of rust or corrosion.

551,757 ALEXANDER, P., CRANSTONE, E. L., and VAPCO, LIMITED. Deposition of metals.

551,841 TRIGGS, W. W. (Carnegie-Illinois Steel Corporation). Methods and apparatus for continuously electroplating metallic strips.

551,842 ALUMINIUM LABORATORIES, LIMITED. Separating ingots in a continuous casting process.

551,872 FAIRWEATHER, H. G. C. (National Smelting Company). Aluminium base alloys.

551,915 THOMAS, M. H. Flux for use in the welding of nickel chrome iron alloys and nickel chrome alloys.

551,931 GENERAL MOTORS CORPORATION. Manufacture of porous metal sheets and the like.

551,936 FORD MOTOR COMPANY, LIMITED, RENSHAW, E. S., and HARTNETT, J. V. Acid process metallurgical furnaces.

551,973 BOLD, H. Machines for drilling hard metals and stones.

552,031 ARNOLD, C. (Lester Engineering Company). Pressure-casting machines.

552,037 BRITISH THOMSON-HOUSTON COMPANY, LIMITED (General Electric Company). Automatic systems for controlling the temperature of furnaces, ovens and the like.

NOTES FROM THE BRANCHES

London.—The next meeting is to be held at Charing Cross Hotel, Strand, London, W.C.2, at 6 p.m., on Thursday, May 27, when Mr. G. N. E. Wells, of J. Stone & Company, Limited, is reading a Paper on "Some Metallurgical Factors of Interest to the Practical Aluminium Founder."

STEEL SALES ABOVE MAXIMUM PRICES

Heavy fines were imposed at the Mansion House, London, recently, when W. E. Hughes Subsidiaries (1936), Limited, of Ibex House, Minories, E.C., were charged on 15 summonses with breaches of the Control of Iron and Steel (No. 15) Order, 1941, by selling to the Petroleum Board, the United Glass Bottle Manufacturers (Charlton), Limited, the British Oxygen Company, Limited, and others, certain materials for which a maximum price was in force at prices which exceeded that limit. Mr. Matthew William Walker, of Hanningfield, near Chelmsford, was summoned as managing director of the company for committing the same offences. Defendants, through their counsel, Mr. Christmas Humphreys, pleaded guilty.

Mr. B. M. Stephenson, who prosecuted on behalf of the Ministry of Supply, said that the defendant company was formed in 1936 and Mr. Walker was in virtual control. At their London office they acted as buying and selling agents—buying steel sheets, etc., at the controlled prices and reselling at from 15 to 25 per cent. in excess of the maximum controlled prices. The capital of the company was £4,000, yet its turnover at the present time was a quarter of a million. The turnover in 1937 was only £16,000; by 1942 it had risen to £211,959. From £380 in 1937 profits had grown, in 1942, to £19,842. The summonses before the Court were only representative of hundreds of transactions, the aggregate overcharge upon which was estimated by accountants to amount to something in the neighbourhood of £9,053, Mr. Stephenson said. When Mr. Walker was seen by an official of the Ministry on these matters, he said that his company was in a unique position, as they were performing a national service, and he considered they were outside the scope of the Control. Their prices had been fixed according to the circumstances of each case.

Mr. Humphreys stated that the defendants were experts in finding materials that were urgently required by Government contractors—very often for a ship in dock. These contractors were prepared to pay any money to get these jobs done quickly, and there was no one but the defendant company who could obtain the necessary materials. It was a work of great national importance, and the charges made by the company were based upon the expenses incurred in obtaining the goods, plus a profit. Mr. Walker had only a fixed salary, and so far as the company was concerned, its profits went to the Government as E.P.T. So there was no loss to the revenue, and although technically offences had been committed, they did not run counter to the main purpose of the regulation.

Alderman Sir John Laurie fined the company £3,000 and 50 guineas costs, and Mr. Walker £3,000.

MAJOR THE HON. JOHN YARBURGH CUNLIFFE-LISTER, elder son of Viscount Swinton, has died of wounds received in action. He was 29. The Hon. John Cunliffe-Lister was a director of the Stafford Coal & Iron Company, Limited.

TIN MINING IN CORNWALL

In a statement accompanying the report and accounts of Tehidy Minerals, Limited, the chairman (Mr. D. W. Thomas) says that the possibility of the company benefiting from the efforts of the Ministry of Supply to secure a greater output of tin from Cornwall, to which he referred last year, has not matured up to now. The whole of the products of the company's producing lessees are taken by the Government and the mineral dues payable thereon are calculated on a fixed price settled by the Ministry; this system, while it achieves the desirable aim of stabilising at any rate one item of the cost of producing tin, does so at the expense of the mineral owners, Mr. Thomas comments. It might be thought that with the source of so much of the world's tin supplies in enemy hands, the resources of Cornwall would have been quickly developed as an alternative; unfortunately, and quite apart from any other consideration, the difficulty of obtaining sufficient labour alone makes the opening up and development by private enterprise of any new properties out of the question for the duration of the war. It is noted with interest, however, that considerable attention is being directed to the post-war development of the Cornish mining industry. There is no doubt about the existence of great mineral wealth in Cornwall and it is to be hoped that as soon as circumstances permit, its development will be seriously taken in hand.

INTERNATIONAL NICKEL CO.

Presiding at the annual meeting of the International Nickel Company of Canada, Limited, Mr. Robert C. Stanley (chairman and president) recalled that at the last meeting he discussed the expansion project which had been undertaken at an estimated cost of $35,000,000 to increase the output of nickel in all forms by 50,000,000 lbs. per annum over the 1940 production rate. This work, he said, was being promptly and satisfactorily completed, and they were already producing nickel at the rate forecast. Distribution of nickel, now restricted to essential war uses, remained entirely under the direction of Governmental agencies. They continued to be the largest producer of copper in the British Empire and the world's largest producer of the platinum metals.

ZINC OXIDE PRICES

The Minister of Supply has made the Control of Non-Ferrous Metals (No. 12) (Copper, Lead and Zinc) Order, 1943, which came into force on May 6. This Order increases the maximum prices of the red, green and white seal brands of zinc oxide by £3 2s. 6d. per ton in each case, bringing them to the following levels: Red seal, £31 10s. per ton; green seal, £33; white seal, £34, for delivery in lots of not less than two tons. The present maximum prices have been in force since December, 1939, but an increase is now necessary to cover the higher costs of production and delivery.

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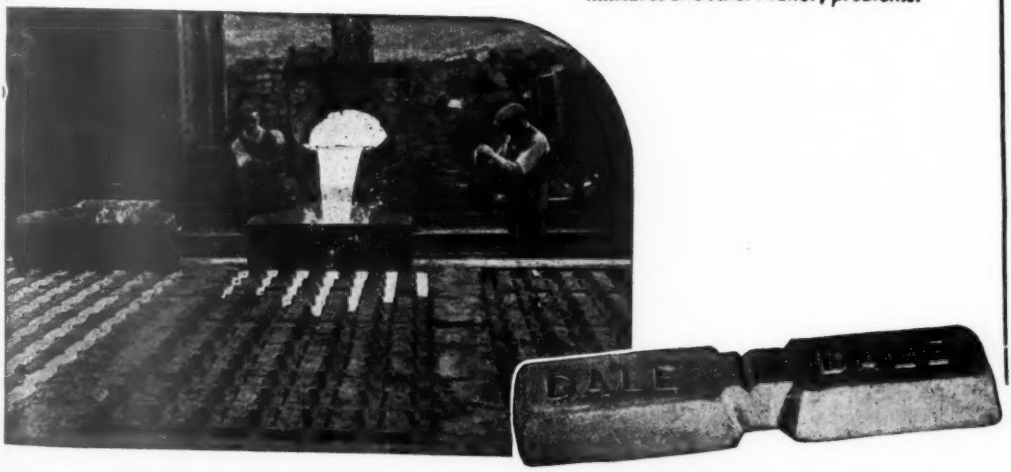
Users are invited to avail themselves of the Stanton Technical Service which offers free expert advice on special mixtures and other Foundry problems.



THE STANTON IRONWORKS COMPANY LIMITED, NEAR NOTTINGHAM

PERSONAL

MR. F. H. HOULT, who is well known in Scottish and East Midland foundry circles, has been appointed manager of Kent Alloys, Limited, Strood.

MR. J. N. KILBY, general manager of the Redbourn Works, Scunthorpe, of Richard Thomas & Company, Limited, has accepted the invitation of the Lincolnshire Iron and Steel Institute to become president for this year. Mr. Kilby was recently re-elected chairman of the Lincolnshire Ironmasters' Association for a second year.

MR. F. L. BURDER planted a tree at the Burder Park, Carron, Falkirk, on April 28, to mark his association with the park and his jubilee as a voting partner of the Carron Company, he having been appointed such on April 25, 1893. In October, 1927, he became chairman of the company, a position held until his retirement in April, 1941.

MR. GEO. PATE, manager for the Carron Company, Falkirk, has completed 50 years' service with the company. Mr. Pate joined the company in December, 1893, as pig-iron and coal salesman, after eighteen years' experience with Merry & Cuninghame. In 1901 he was appointed assistant manager and in 1912 took over the duties as manager. This term of managership has only once been exceeded in the company's long history.

Will

CRABTREE, A. E., of Scarborough, joint managing director of R. W. Crabtree & Sons, Limited, of Leeds £65,187

MORE PART-TIME WORKERS

The direction of persons into additional unscheduled full-time occupations and the introduction of directing orders to part-time workers, up to a maximum of 30 hours a week, are contemplated under a new Ministry of Labour Order which came into force on May 8. Hitherto, few people have been directed into full-time work not covered by an Essential Work Order. It has now become necessary, however, to contemplate a considerable increase in the number of such directions, particularly with a view to supplying substitutes for workers needed elsewhere on work of high importance.

Until now it has been the rule not to issue compulsory orders for part-time work, but the considerable extension and growing importance of such labour, and its use to the best advantage, has made its direction necessary, where required, although wholesale directions are not contemplated. The number of present part-time workers (mainly women) is over 600,000.

MR. FREDERICK BULL, principal of a chain manufacturing business in Margaret Street, Walsall, has died in his 75th year. He was associated with his father in the business and on the death of his father 23 years ago took full control of the firm.

IRONFOUNDERS' COLLABORATION WITH SOLID FUEL INTERESTS

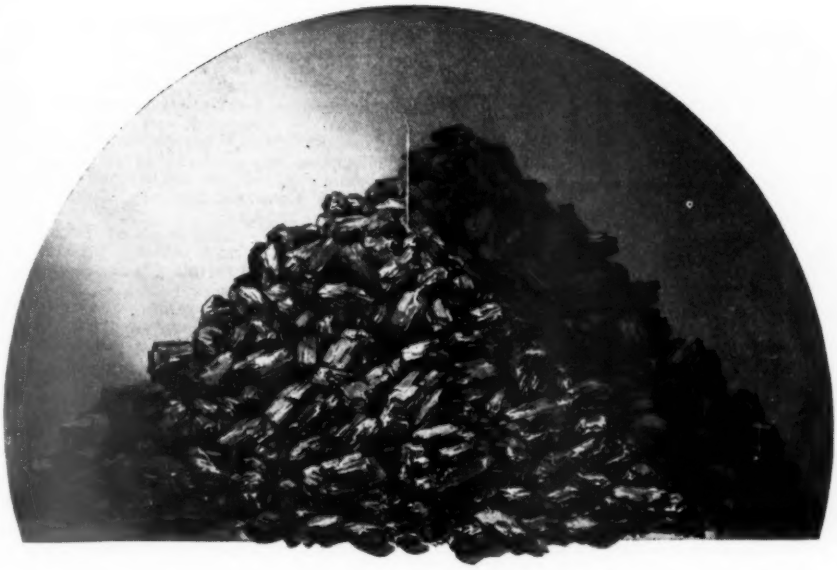
In his presidential address to the Combustion Appliance Makers' Association (Solid Fuel), MR. WILLIAM RENNIE referred to the Domestic Appliances Development Group; nearly all the leading makers and many of the smaller makers of domestic coal-burning appliances had joined the Group and, through it, were collaborating in the work of the Domestic Fuels and Appliances Committee set up jointly with the coal producers and coal distributors. In this connection, he wished to pay a special tribute to the British Ironfounders' Association, without whose collaboration the formation of the D.A.D.G. would have been impossible. There was one point about the use of solid fuel for domestic heating and cooking that was even now, perhaps, not sufficiently appreciated. "I refer," he said, "to the importance of stocks of solid fuel in meeting the sudden heating peak loads which occur in this country owing to our uncertain winter climate." It often happened that for one or two weeks in the year, the domestic consumption of fuel was more than double the average for the year. It was obvious that such demands could only be met by storage. Sir John Dalton, in a recent notable address, asserted that the electrical industry could not face with equanimity any increase in its responsibilities for peak load winter heating, and he thought that the same applied to gas. With both these fuels, it was necessary to instal plant with a capacity equal to the maximum demand, because electricity could not be stored at all and gas only up to 48 hours. Solid fuels, on the other hand, could not only be stored, but the stocks could be built up during the summer months, when, in peacetime, collieries tended to work short time for want of markets. From the point of view both of equalising the winter load and of spreading employment in the coal industry, the domestic use of solid fuel seemed to be an indispensable element in our national economy.

NEWS IN BRIEF

REPRESENTATIVES of 150 small engineering concerns in London, Birmingham, and other industrial areas, meeting in London last week, decided to form an association to protect their interests.

PERMISSION TO DEAL has been granted in respect of £58,393 ordinary stock of the Brush Electrical Engineering Company, Limited. This stock (the units are 5s.) has been issued in connection with the exercising of options to subscribe for ordinary shares at par.

ADDRESSING A MEETING of the North-East section of the Institution of Production Engineers at Newcastle-upon-Tyne, Lord Ridley (Northern Regional Controller, Ministry of Production) expressed the view that on Tyneside they had become rather static in engineering methods. The Institution of Production Engineers was an organisation needed to give assistance and he emphasised that the Ministry of Production attached much importance to the study of the matters on which the Institution was engaged.



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Efficient Insulation can permit greater output — lower production costs — improved furnace control & operating conditions.

EVERY works — every citizen — is now in the front line in the battle for fuel. Heat losses are a burdensome waste which must be prevented wherever possible. The gravity of the situation demands that even the most essential war industries should rigidly conserve fuel. Wherever insulation is applicable an efficient system should be installed — without delay. The 'Amberlite' range of insulating bricks covers the requirements of every industry and large quantities are available from stock.

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COMPANY NEWS

(Figures for previous year in brackets.)

F. Reddaway & Company—Dividend of 8% (same).

Walter Spencer & Company—Interim dividend of 5%.

Richard Johnson & Nephew—Dividend of 9% (same).

Hopkinsons—Final ordinary dividend of 12½%, making 17½% (15%).

Peglers—Dividend on the "A" and "B" ordinary shares of 23½% (same).

J. W. Singer & Sons—Dividend of 10% on the ordinary shares (same).

Permutit—Net profit for 1942, £14,639 (£11,703); ordinary dividend of 8% (same); forward, £15,450 (£17,170).

Humphreys—Net profit for the year to November 30, 1942, £41,384 (£44,723); ordinary dividend of 10% (same).

Tehidy Minerals—Profit for 1942, £9,296 (£10,159); final dividend of 5%, making 10% (12½%); forward, £9,935 (£7,988).

Anti-Attrition Metal—Net profit for the year to July 31, 1942, £13,030 (£15,382); dividend of 5% (same); forward, £2,584 (£1,929).

Pressed Steel—Net profit for 1942, £179,877 (£170,615); final ordinary dividend of 17½%, making 27½% (same); forward, £361,300 (£310,057).

Glenfield & Kennedy—Net profit for the year to March 31 last, £63,149 (£63,296); final dividend of 5% and a bonus of 10%, making 20% (same).

Engineers & Ironfounders—Net profit for 1942, £5,264 (£6,854); dividend on the 7% cumulative preference shares, £1,805; final dividend of 7½% on the ordinary shares, making 10% (same), and a bonus of 1s. a share (same); to general reserve, £960; forward, £7,483 (£6,918).

William Beardmore—Trading profit for 1942, after depreciation and provisions for taxation and deferred repairs, £204,843 (£201,507); debenture and other interest, £27,756 (£26,376); net profit, £183,709 (£182,895); 5½% preference dividend, £26,125; ordinary distribution of 10%, £47,500 (same); to war contingencies reserve, £100,000 (same); forward, £234,499 (£224,415).

Johnson & Phillips—Profit for 1942, £507,797 (£502,375); taxation reserve, £310,000 (£260,000); depreciation, £41,951 (£31,750); debenture service, £22,000 (same); staff pensions, £9,053 (£7,747); net profit, £111,454 (£105,987); to special reserve for contingencies, £30,000; to research and development account, £5,000; dividend of 15% (same); forward, £101,724 (£85,270).

Brush Electrical Engineering—Net profit for 1942, £118,130 (£88,701); brought in, £6,601 (£11,039); A.R.P., £4,572 (£3,611); war damage insurance, £4,074 (£4,353); debenture redemption premium written off, £9,988 (nil); share issue expenses written off, £9,585 (nil); tax provision, £25,000 (nil); to general reserve, £25,000 (£50,000); written off patents and goodwill, nil (£16,501); ordinary dividend of 8% (6%); forward, £10,271 (£6,601).

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"CASSEL"—Furnaces. IMPERIAL CHEMICAL INDUSTRIES, LIMITED, Wexham Road, Slough, Bucks.

"DURAL"—Aluminium and alloys. JAMES BOOTH & COMPANY (1915), LIMITED, Argyle Street, Nechells, Birmingham, 7.

"SPRINGBOX"—Metal latches and locks. JAMES B. MILNER & COMPANY, Stanway, Bryn Newydd West, Prestatyn, Flintshire.

"INSU-GLASS"—Glass-insulated electric wires and glass-insulated electric cables. SAXONIA ELECTRICAL WIRE COMPANY, LIMITED, Roan Street, Greenwich, London, S.E.10.

"CROSTHWAITE"—Elevators and conveyors, furnaces, mechanical stokers, etc. CROSTHWAITE FURNACES & SCRIVEN MACHINE TOOLS, LIMITED, York Street Ironworks, Leeds.

"LEVIS"—Air compressors, rotary pumps, centrifugal pumps, internal combustion engines, hand tools, etc. LEVIS, LIMITED, Levis Motor Works, Station Road, Stechford, Birmingham.

"MANCONEL"—Alloys of manganese, copper and nickel for use in the manufacture of electrical apparatus. MALLORY METALLURGICAL PRODUCTS, LIMITED, 78, Hatton Garden, London, E.C.1.

"LOCKER-TRAYLOR"—Vibrating screens, sifting machines, vibrating mechanism and feeders for screening sifting machines. LOCKERS (ENGINEERS), LIMITED, Ellesmere Works, Church Street, Warrington.

"TECHNICHROME"—All goods included in Classes 7 and 9 having a protective coating of chromium. ALUMINIUM PROTECTION COMPANY, LIMITED, Di-Alumin Works, Brentfield Road, Willesden, London, N.W.10.

"METRIGAP" and "TRIGATRON"—Intermittent electric discharge devices and thermionic and electronic pulse generators. METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED, Number One, Kingsway, London, W.C.2.

QUAKER'S HEAD IN MEDALLION (Device)—Partly-wrought sheet metal, sheet metal goods, constructional framework of iron and steel, metal fencing, wire screening, etc. PROCTER BROS. (WIREWORKS), LIMITED, Leeds Wire Works, Call Lane, Leeds.

"PIKES" (and device)—Control instruments for boilers; electric batteries, accumulators, arc welding apparatus, soldering irons, etc.; corrugated sheet iron; tool steel, etc. GEORGE PIKE, LIMITED, Equipment Works, Alma Street, Birmingham, 6.

CONTRACTS OPEN

The date given is the latest on which tenders will be accepted. The address is that from which tender forms may be obtained.

Abertillery, May 17—Bare copper and insulated wire, cables, etc., for the Urban District Council. Mr. D. Thomas, electricity engineer and manager, 40, Somerset Street, Abertillery.

Belfast, May 24—Iron castings, cast-iron pipes, etc., for the Town Council. The Engineer and Manager, Gasworks, Ormeau Road, Belfast.

SEVEN PILLARS OF PROGRESS

7. The pursuit of scientific inquiry demands complete intellectual freedom and unrestricted international exchange of knowledge and it can only flourish through the unfettered development of civilised life.

"The Charter of Science"—British Association, 1941

When books were chained, learning was confined to the few, and the world, in general, advanced little beyond barbarism. Three centuries of unfettered knowledge have now enhanced the lot of mankind. The pace grows faster as communications between order-loving nations grow and increase. Progress in civilisation is a function of the ability to interchange information frankly, whereby man may learn from his fellows. All peoples must be free to enjoy intellectual liberty without fear or restraint.

In the realm of steel this organisation will continue to pursue scientific inquiry through the medium of their scientists and technologists. We are willing at all times to disseminate the fruits of these labours for the benefit of our fellows. Much has been contributed towards the progress of metallurgical science in the past and it is our earnest hope that in the years ahead, when the shadow of barbarism has passed from all the shackled territories, that we may take an even greater part in helping to create a free and unrestricted international democracy of science based on the highest ethical standards.

THE UNITED STEEL COMPANIES LTD

THE UNITED STEEL COMPANIES LIMITED

Steel, Peach & Tozer, Sheffield | Appleby-Frodingham Steel Co. Ltd., Scunthorpe | The Rotherwale Collieries, Treeton
Samuel Fox & Co. Ltd., Sheffield | Workington Iron & Steel Co., Workington | United Coke & Chemicals Co. Ltd.
United Strip & Bar Mills, Sheffield | The Sheffield Coal Co. Ltd. | Thos. Butlin & Co., Wellingborough

U·S.P.7

Raw Material Markets

IRON AND STEEL

Although the light-foundry trade is by no means fully employed, demand for high-phosphorus pig-iron is at quite a high level, due to the fact that this type of iron is being used fairly extensively by heavy engineering and allied foundries owing to the shortage of better qualities of iron. Ample supplies are forthcoming to meet all requirements, and many consumers have been able to build up quite useful reserve stocks. Government departments have lately placed additional orders with light-castings makers, and the outlook for this section is much more cheerful than has been the case for a long time past.

Heavy engineering and allied foundries continue to have as much work as they can deal with, while malleable foundries, too, are fully engaged on business of a priority character. Supplies of hematite, low-phosphorus and other better quality irons continue to be very strictly controlled and, generally speaking, these grades are only available to priority users unable to utilise alternative descriptions.

Foundry coke is relatively easy to procure and deliveries are more than sufficient to satisfy all requirements, while stocks have been accumulated at many consuming points. It is the custom of many of the larger users who have the necessary accommodation to carry reserve supplies of coke and, where these are in need of replenishment, the work is being carried out according to schedule.

Makers of alloy steels are returning excellent outputs, but, even so, they are unable to overtake the demand from munitions and armaments works, etc., and further efforts are to be made to expand production. During the past year or so very considerable progress has been made in this direction. Other sections of the steel industry continue to operate to capacity. Plate makers, for example, are inundated with orders, particularly for grades suitable for the shipbuilding industry. While the sheet makers remain very active, there has been some recession of orders for certain war requirements, but this is likely to be only a temporary phase.

MR. HANS RENOLD, founder of Hans Renold, Limited, one of the predecessors of the Renold & Coventry Chain Company, Limited, died on May 2 at Grange-over-Sands, Lancs, in his 91st year.

NON-FERROUS METALS

The Prime Minister has recently spoken in quite reassuring terms of the latest position concerning the menace of the U-boat campaign. Serious as this is still, Mr. Churchill was able to state that we were more than holding our own. This is encouraging in view of our dependence on shipping for supplies of many materials, including non-ferrous metals. Copper continues to be available sufficiently to meet all priority requirements, but rigid economy is being exercised in the use of this and other metals. The hazards which have to be faced by those responsible for bringing cargoes to our shores are such that extravagant usage cannot be tolerated.

In the House of Commons, last week, Mr. Creech Jones asked the Secretary for the Colonies what agreement was reached with the Nigerian tin companies governing the price of tin. Col. Stanley replied that, while the details of the proposed agreement with the main Nigerian tin producers were still under discussion, tin concentrates were being supplied by those producers on the basis of the offer made by the Ministry of Supply to purchase on direct contracts at cost of production plus the profit per ton realised in a pre-war period—either the year ended August 31, 1939, or the average of the three years ended on that date, at the option of the producers. Where—as with certain smaller producers—such a direct contract was inapplicable, the Ministry of Supply was offering to buy through the Nigerian Supply Board at a price which was approximately the average to be realised by producers on direct costed contracts.

A GENERAL MEETING of the Institute of Welding will be held at the Institution of Civil Engineers, Great George Street, London, S.W.1, on May 26 at 6 p.m., at which a Paper on "Welding Research and Development in the United States of America" will be presented by H. W. G. Hignett, B.Sc. (Eng.), A.I.C. Admission will be by ticket only.

THE INSTITUTION OF MECHANICAL ENGINEERS announces that at a general meeting on May 21 Dr. G. Schlesinger will present a Paper on "Surface Finish and the Function of Parts." At a meeting of the Applied Mechanics Group to be held on June 18 Dr. Hugh O'Neill will present a Paper on "The Significance of Tensile and Other Mechanical Test Properties of Metals." Both meetings will be at 5.30 p.m. at the Institution, Storey's Gate, St. James's Park, London, S.W.1.

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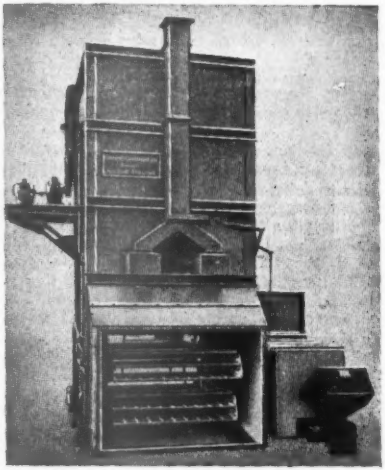

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CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, May 12, 1943

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130e.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—No. 1 (S & P 0.03 to 0.05 per cent.): Scotl d, N.-E. Coast and West Coast of England, 138s. 6d.; Sheffi d, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s.; South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South taffs, 220s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

(Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.)

Ferro-silicon (5-ton lots): 25 per cent., £21 5s.; 45 per cent., £23 10s.; 75 per cent., £36 10s.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 6s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/6 per cent. C, £44; max. 2 per cent. C, 1s. 0½d. lb.; max. 1 per cent. C, 1s. 1½d. lb.; max. 0.5 per cent. C, 1s. 1½d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 5d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.41 to 0.60 per cent. C, £14 10s.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d., 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s., joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ¾ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d. hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d., f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20×14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 10s.

Tin.—99 to under 99.75 per cent., £275; 99.75 to under 99.9 per cent., £276 10s.; min. 99.9 per cent., £278 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25; ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11½d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 10½d.; wire, 10½d.; rolled metal, 10½d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15½d. per lb.; brazed tubes, 15½d.; wire, 10d.

Phosphor Bronze.—Strip, 13½d. per lb., sheets to 10 w.g., 14½d.; wire, 16d.; rods, 16d.; tubes, 21½d.; castings, 19d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4½d. to 1s. 10½d.; to 15 in. wide, 1s. 4½d. to 1s. 10½d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5½d. to 1s. 11½d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6½d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9½d. Wire round, to 10g., 1s. 7½d. to 2s. 2½d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6½d. upwards.

NON-FERROUS SCRAP

Controlled Maximum Prices.—Bright untinned copper wire, in crucible form or in hanks, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; copper firebox plates, cut up, £57 10s.; clean untinned copper, cut up, £56 10s.; braziery copper, £53 10s.; Q.F. process and shell-case brass, 70/30 quality, free from primers, £49; clean fired 303 S.A. cartridge cases, £47; 70/30 turnings, clean and baled, £43; brass swarf, clean, free from iron and commercially dry, £34 10s.; new brass rod ends, 60/40 quality, £38 10s.; hot stampings and fuse metal, 60/40 quality, £38 10s.; Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin, £74 10s., all per ton, ex works.

Returned Process Scrap.—(Issued by the N.F.M.C. as the basis of settlement for returned process scrap, week ended May 8, where buyer and seller have not mutually agreed a price; net, per ton, ex-sellers' works, suitably packed):—

BRASS.—S.A.A. webbing, £48 10s.; S.A.A. defective cups and cases, £47 10s.; S.A.A. cut-offs and trimmings, £42 10s.; S.A.A. turnings (loose), £37; S.A.A. turnings (baled), £42 10s.; S.A.A. turnings (masticated), £42; Q.F. webbing, £49; defective Q.F. cups and cases, £49; Q.F. cut-offs, £47 10s.; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; process and manufacturing scrap containing over 62 per cent. and up to 68 per cent. Cu, £43 10s.; ditto, over 58 per cent. to 62 per cent. Cu, £38 10s.; 85/15 gilding metal webbing, £52 10s.; 85/15 gilding defective cups and envelopes before filling, £50 10s.; cap metal webbing, £54 10s.; 90/10 gilding webbing, £53 10s.; 90/10 gilding defective cups and envelopes before filling, £51 10s.

CUPRO NICKEL.—80/20 cupro-nickel webbing, £75 10s.: 80/20 defective cups and envelopes before filling, £70 10s.

NICKEL SILVER.—Process and manufacturing scrap: 10 per cent. nickel, £50; 15 per cent. nickel, £56; 18 per cent. nickel, £60; 20 per cent. nickel, £63.

COPPER.—Sheet cuttings and webbing, untinned, £54; hell-band plate scrap, £56 10s.; copper turnings, £48.

IRON AND STEEL SCRAP

(*Delivered free to consumers' works. Plus 3¾ per cent. dealers' remuneration. 50 tons and upwards over three months, 2s. 6d. extra.*)

South Wales.—Short heavy steel, not ex. 24-in. lengths, 82s. to 84s. 6d.; heavy machinery cast iron, 87s.; ordinary heavy cast iron, 82s.; cast-iron railway chairs, 87s.; medium cast iron, 78s. 3d.; light cast iron, 73s. 6d.

Middlesbrough.—Short heavy steel, 79s. 9d. to 82s. 3d.; heavy machinery cast iron, 91s. 9d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 89s. 3d.; medium cast iron, 79s. 6d.; light cast iron, 74s. 6d.

Birmingham District.—Short heavy steel, 74s. 9d. to 77s. 3d.; heavy machinery cast iron, 92s. 3d.; ordinary heavy cast iron, 87s. 6d.; cast-iron railway chairs, 87s. 6d.; medium cast iron, 80s. 3d.; light cast iron, 75s. 3d.

Scotland.—Short heavy steel, 79s. 6d. to 82s.; heavy machinery cast iron, 94s. 3d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 94s. 3d.; medium cast iron, 77s. 3d.; light cast iron, 72s. 3d.

(NOTE.—*For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less.*

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WANTED.—Manager, for non-ferrous metal foundry in North-East England; must be thoroughly conversant with moulding machines and control of pattern-shop and female labour; permanent position for suitable man.—Write, stating experience and salary required, to Box 796, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOUNDRY MANAGER required for semi-mechanised West Country ferrous and non-ferrous foundry; permanent position, with future for suitable applicant; fully conversant with modern foundry and metallurgical practice; particulars in confidence—when available, age, salary required, and experience, Box 828, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOUNDRY WORKS MANAGER required; North-East Coast; should have good experience in light castings from power and hand machines, also general engineering repetition work—all grey iron.—State age and qualifications, etc., to Box 816, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

SUPERINTENDENT or HEAD FOREMAN required, of wide general experience, to take charge of Brass Foundry section in Non-Ferrous Metal Refining Work in Birmingham area; non-ferrous experience desirable, but not necessarily essential; remunerative, progressive, and permanent position for the right man.—Apply, stating wages required, to Box 824, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

MELTING HEAD FOREMAN required by a Modern Laboratory controlled Bronze Foundry; experience with oil-fired tilting furnaces essential; progressive and permanent position for capable applicant.—Write, stating age, experience, and salary required, to Box R.717, WILLING'S, 362, Grays Inn Road, London, W.C.1.

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URGENTLY WANTED.—10- to 15-Ton Electric Overhead TRAVELLING CRANE; not under 40 ft. span; 3-motor type, for standard a.c. voltage; must be quick acting and ready for use.—Box 822, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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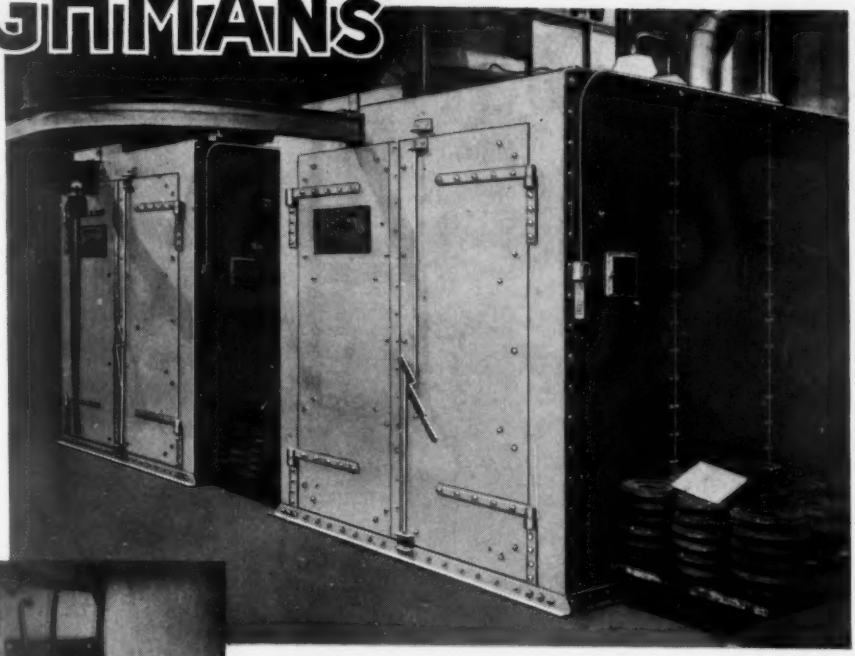

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VOL. 70. No. 1395. MAY 13, 1943
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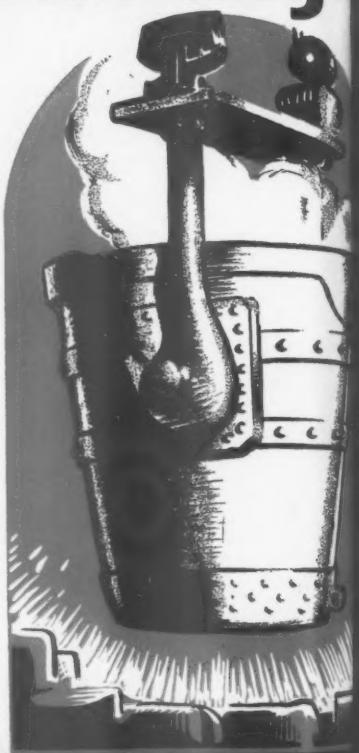

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